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The work bids fair to be a most satisfactory one. A similar work for North America is greatly to be desired, for Lesquereux and James's *Mosses of North America* is now twenty years old.—C. R. B.

The problems of life.

THIS BOOK² contains a theory of ontogenic development, or rather an exposition of the fundamental principle governing ontogenic phenomena. To use an illustration of the author: if one wished to study the flow of rivers, and to determine in advance the course of a river in all its details, it would be necessary to know the rapidity and density of the water, the inclination and geological structure of the bed and banks at all points of its course, resistance of materials composing these, etc., so that the solution becomes practically impossible in detail. But theoretically the fundamental principle involved is simply that of gravitation. It is the same with the problem of development. Knowledge of all the various secondary factors that complicate each case is not necessary; what is wanted is knowledge of the fundamental principle governing all ontogenic phenomena. The author believes he has found this in the principle of "développement monodique."

The principle of monodic development is derived from the author's ideas of the nature of assimilation, growth, and of cell division, which are discussed in the first part of the work, and are outlined in a review of it in this journal.³

The biomolecules of the egg assimilate the deutoplasm and so reproduce by division; this causes division of the biomeres, and this cleavage (cell division). Thus assimilation is the first and necessary cause of each cleavage, and the assimilation is accompanied by progressive chemical ontogenic changes. The author here introduces as the main prop of the monodic theory the principle of "heterogenetic" development, viz.: that, owing to the nature of "biomolecular development," two daughter-cells must be different in constitution both from one another and also from the mother-cell. This is established as a universal principle in development by the consideration that there are only two other possible modes of cell division, viz.: *autogenetic*, in which the daughter-cells are like each other and also like the mother-cell, and *homogenetic*, in which the daughter-cells are like each other but different from the mother-cell, and that these are excluded as possible modes of development, for the assumption of either of them as a mode of development leads to an absurdity.

Thus it follows that the constitution of the cells alters with each cleavage which *ex hyp.* is preceded by a period of assimilation.

The next step in the hypothesis leads to the principle of monodic develop-

² GIGLIO-TOS, ERMANO, Les problèmes de la vie. II^e partie; l'ontogénèse et ses problèmes. 8vo. pp. 368. Cagliari, chez l'Auteur, à l'Université, 1903.

³ BOT. GAZ. 31:275. 1901.

ment. Supposing that the bioplasm of the egg passes through stages *a*, *b*, *c*, owing to the nature of the processes of assimilation of the biomolecules, biomeres, etc., it is clear, the author states, that the first division of the egg cell *a* must result in two cells, one of which, on the principle of heterogenetic development, must be *b* and the other different from *b*; it may be *c* or it may be something different. "There are no other possible suppositions." The author examines the second alternative, "polyodic development," first, and arrives at the conclusion that this leads to an absurdity; hence the egg *a* must divide into *b* and *c*; *b* must divide into *c* and *d*; *c* into *d* and *e*, and so on to a particular limit fixed by the constitution of the egg. This is the principle of monodic development.

It would take us too long to follow the author's exposition of how this principle leads to a "rational" explanation of the development of all animals and plants, leaving no essential phenomena unexplained; and, moreover, it is not necessary to do so for already two things must be clear: (1) that the author has reared an inverted pyramid upon his conception of assimilation and growth; (2) that by the naïve method of proposing selected theoretical alternatives and demonstrating the absurdity of all but one, any principle may be "proved," the premises being granted.

Some of the main features of this system remind one of certain theories of Weismann, *e. g.*, the theory that protoplasm is a symbiotic aggregation of various orders of living units. But Weismann is far too good a biologist to endow the molecules themselves with life. The principle of "heterogenetic development" has some points of resemblance to the principle of "qualitative nuclear division" (Weismann). But the system of Giglio-Tos is more artificial than that of Weismann, and he tries to solve by force of *a priori* reasoning what Weismann is careful to consider on the evidence. In many respects the theory departs widely from Weismann's.

The book contains no new facts, though the author is evidently familiar with some of the current embryological literature; but he makes use of the knowledge only to show that his theory is capable of explaining all of the results of experimental embryology. With other results of recent embryological work he is apparently quite unfamiliar. Thus he declares positively in favor of the doctrine of isotropy of the egg, without the least consideration of all the many facts demonstrating that the organization of the egg is causally related to some of the most fundamental phenomena of development.

It is a Rip van Winkle experience to read this production; one wonders if all the results of exact and experimental embryology are only a pleasant dream, and if such attempts to explain inheritance by a single principle, characteristic of the biology of twenty or thirty years ago, are alone real. Fortunately even this book cannot bring one to such a conviction, and it is even probable that it will not be considered superfluous in the future to work for the discovery of new facts in ontogeny.—FRANK R. LILLIE.